

Strontium-90 Deposition at SMO and MLO Through 1990

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INTRODUCTION

Deposition samples have been collected at American Samoa (SMO) since 1965 and Mauna Loa, Hawaii (MLO) since 1959 for the Environmental Measurements Laboratory's (EML) Global Fallout Program. Sampling at both locations has been supported by CMDL for the majority of these years through a cooperative agreement. These samples, along with others collected in our global network, were regularly analyzed for ^{90}Sr . Strontium-90 is a radioactive fission product, and most of the ^{90}Sr measured in deposition samples were produced as a result of atmospheric nuclear weapons testing. Strontium-90 is an important radionuclide from a health perspective because it has a long half-life (28 years), is produced in relatively large quantities during nuclear fission reactions, and has a high bio-accumulation potential. The data generated by this program are used to determine the distribution and inventories of ^{90}Sr deposited on the earth's surface. Many factors controlling the transport and fate of atmospherically released radionuclides have been revealed by this program. The results are periodically published in EML reports [Monetti and Larsen, 1991].

MATERIAL AND METHODS

Deposition samples have been collected at MLO and SMO using two different collectors, either an ion-exchange column or a 23-L polyethylene bucket. Using either method, the collectors are exposed to bulk (wet and dry) atmospheric deposition, and a new sample is collected each month. The ion-exchange columns were used at MLO and at SMO until 1976. The column was packed with Dowex-50W ion-exchange resin that efficiently removes ^{90}Sr and other cations from the aqueous phase of the sample, while the particulates are trapped in the paper pulp. The column was placed in a wooden housing unit, and a polyethylene funnel with a diameter of 30 cm was attached to the top of the column. Presently, an open 23-L polyethylene bucket with a diameter of 29 cm is being used as a deposition sampler at both locations. The precipitation samples collected are shipped to EML and are passed through an ion-exchange column. The contents of the columns are analyzed for ^{90}Sr using established radiochemical procedures [Chieco et al., 1992].

RESULTS

The annual ^{90}Sr deposition data through 1990 for MLO and SMO are summarized in Figure 1. The deposition is reported in units of activity per unit area ($\text{Bq } ^{90}\text{Sr m}^{-2}$). Samples were not collected at SMO prior to 1965, therefore, no data are shown in the corresponding positions on the graph. In all other instances, a lack of data indicates that the samples contained ^{90}Sr activities that were below the detection limit.

DISCUSSION

The trend of ^{90}Sr deposition at MLO, shown in Figure 1, is characteristic of the depositional history throughout most of the world [Larsen, 1984]. There is generally a 1963 maximum value as a result of the large number and high fission yield of the 1962 weapons tests. Reduced ^{90}Sr deposition is observed at both locations for the years 1965 to 1986. The depositional trends during these years were similar at both MLO and SMO, however ^{90}Sr deposition was apparently higher at SMO. Little ^{90}Sr was deposited at either sampling site following the last atmospheric weapons test conducted by China late in 1980. Strontium-90 resulting from the Chernobyl accident in April of 1986 was not found at either location due to the regional nature of this event and its related contaminant transport. Any ^{90}Sr deposited after 1982 is apparently due to resuspension processes and is

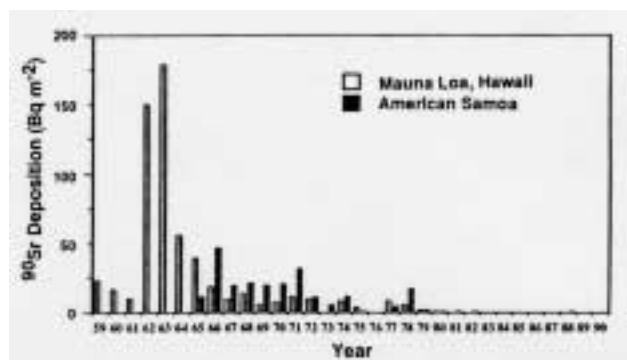


Fig. 1. Annual ^{90}Sr deposition at Mauna Loa, Hawaii, and American Samoa from 1959 to 1990.

insignificant compared to historic deposits. The ^{90}Sr inventory at the end of 1990 determined from the MLO deposition data is 290 Bq m^{-2} . A total inventory cannot be calculated for SMO because there is no SMO data available during the peak deposition period prior to 1965. MLO and SMO are just two sites of the many locations where deposition samples are collected for EML's Global Fallout Program. Using data from all the sampling stations enables us to determine the global distribution and magnitude of ^{90}Sr deposition.

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